SILICON PENETRATION DEVICE WITH INCREASED FRACTURE TOUGHNESS AND METHOD OF FABRICATION

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TECHNICAL FIELD

This invention relates generally to a method for strengthening silicon penetration devices such as needles or probes by increasing fracture toughness.

BACKGROUND

It is well known in the art that silicon is a brittle substance. A penetration device constructed from single crystal silicon must possess a certain degree of mechanical robustness in order to ensure successful use of the needle without accidental fracture of the needle in patients. The device may have an interior channel (a hollow through which fluids can pass for sampling or injection) or it may be solid (for use as a lancet or probe). Integrated circuit and MEMS (microelectromechanical systems) technologies are used to fabricate these silicon penetration devices. Common MEMS fabrication methods, such as bulk etching with potassium hydroxide solution, leave the surface of the penetration device in a roughened state, with resultant increase in surface flaws. The actual failure of the silicon penetration device is the result of microcrack propagation initiated at a flaw on the surface of the material. It is important therefore, to increase the fracture toughness of the penetration device to permit reliable skin penetration without breakage.